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third and fourth laser shock peened surfaces respectively.

REMARKS

The Office Action mailed June 11, 1997 has been carefully considered and the amendments above and following remarks are respectfully submitted in response to the Examiner's Objection to Figure 1 in the Drawings and the Specification and Rejection of Claims 1-20.

DRAWINGS

1. The Examiner's Objection to Figure 1, because hatching has not been utilized to indicate the sectional portions, has been studied and the Applicants respectfully submit that correction is not required. The Mannava patent 5,591,009 uses the same drawings and no objections were found with the drawings in that or any other case using the same type of drawings. The specification clearly points out that the entire figure is cross sectional not portions thereof.

SPECIFICATION

2. The Examiner's Objection to the disclosure, because of the listed informalities, has been studied and appropriate corrections have been made above as required by the Examiner.

Claim Rejection - 35 USC §103

3. The Examiner's rejection of Claims 2-5, 7-9, 12-14, and 17-19 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention has been carefully studied and the Applicants have made the Amendments above to the appropriate Claims to overcome this Rejection by eliminating all double recitations of the limitations in the independent Claim from which they depend.

Claim Rejection - 35 USC §102(e)

4. The Examiner's rejection of Claims 1-20 under 35 U.S.C. 102(e), as being clearly anticipated by Mannava 5,591,009 ('009), has been carefully studied and the Applicants respectfully disagree. The Applicants respectfully submit that the Claims of the present invention are not clearly anticipated by Mannava 5,591,009, because '009 does not disclose a compressor blade with laser shock peened edges, in fact the term "compressor blade" appears not to be in the '009 patent. The '009 reference fails to show many of the elements found in Claims 1-20 relating to compressor blades, compressor blade edge portions, and laser shock peened surfaces and regions along compressor blade edges.

Therefore, it is submitted that the Mannava 5,591,009 patent fails to support the rejection of Claims 1-20 under 35 U.S.C. §102(e), because of the absence of features found in these Claims and that these Claims are allowable over the prior art.

Claim Rejection - 35 USC §103(a)

5. The Examiner's rejection of Claims 1-8, 11-13 and 16-18 under 35 U.S.C. §103(a), as being unpatentable over Neal et al. (Neal), in view of the article "Lasers Permit Precision Surface Treatments", has been carefully considered by the Applicants and the Applicants respectfully disagree. The Applicants respectfully submit that these Claims are patentable over the cited art of this Rejection because the article "Lasers Permit Precision Surface Treatments" (column 1, lines 34-39) does not teach laser shock peening of valve seats extending to a depth of 35 mils, for the purpose of reducing wear. The article discloses laser hardening of valve seats by a heat treatment which heats up the valve seats but does not teach laser shock peening which imparts deep compressive residual stresses extending into the surface to a depth in a range of about 20-50 mils. The article

specifically states (col. 1, last paragraph and continuing on col. 2) "Basically the area to be hardened is coated with an energy absorbing material and then scanned with a laser beam. The beam heats the metal to above the transformation temperature to the desired depth as rapidly as possible without melting the surface. Self-quenching occurs because heat is conducted so rapidly into the substrate of the material." There is no confined explosion due to rapid ablation of material on the surface, i.e. there is no laser shock peening disclosed in the reference article.

Therefore, the Applicants respectfully submit that it would not have been further obvious at the time the invention was made to a person having ordinary skill in the art to apply the laser shock peening to the blade of Neal such that the depth of the residual compressive stresses is 35 mils as taught by the article "Lasers Permit Precision Surface Treatments".

The Applicants respectfully submit that the Examiner's combination of prior art and subsequent rejection have been overcome by the amendments and remarks above and that the present Claims are patentable over the combination of cited references because of the differences between the prior art and the Claims at issue. The prior art itself not only fails to teach a particular combination which results in the claimed invention, but in fact, teaches away from and warns against the present invention and is inconsistent with the purposes of the present invention.

Furthermore, the Applicants respectfully suggest the Examiner broke the invention into its constituent elements, found each element of the invention in the prior art, and then claimed it would have been obvious for one of ordinary skill in the art to reassemble those elements into the invention; all of which constitutes the forbidden hindsight reconstruction in analyzing obviousness. In re Mahurkar, Double Lumen Hemodialysis Catheter Patent Litigation, 831 F.

Supp. 1354, 1374-75, 28 U.S.P.Q. 2d 1801 (N.D. Ill. 1993).

The Am. Mach. article makes no reference to treating fan blade edges and Neal desires the impact of the shot, due to gravity shot peening, to be at a maximum oblique angle to the tangent of the edge surface which is designed to lessen the peening force to avoid deformation, which directly contradicts both the Am. Mach. reference and the teaching of the present invention. The present invention uses much greater stress level to far greater depths than the Neal patent which the Neal patent teaches away from and seeks to avoid. The obliqueness of the shot hits in Neal lowers the impact energy and residual compressive stress levels and, thus, would teach a person skilled in the art to stay away from the force of laser shock peening of the present invention and that of the Am. Mach. reference.

The present invention provides laser beam shock induced deep compressive residual stresses extending into the airfoil from the laser shock peened surface to a depth in a range of about 20-50 mils into the laser shock peened regions. There is no indication this is shown in the Neal reference and, in fact, it would appear that Neal is teaching away from these levels and, therefore, away from laser shock peening edges of blade airfoils. In column 5, line 19, Neal clearly shows that he is using the obliqueness on edge impacts to limit and maintain far lower levels of compressive residual stresses than that found in the present invention and in the Am. Mach. reference and which is directly contrary to the present invention and the Am. Mach. reference both in product, process and purpose.

The Examiner has also not shown that the prior art references have the same purposes as each other or as the present invention. References may be combined to establish the obviousness of a claimed invention if some objective teaching exists in the prior art or if knowledge is generally available to one of ordinary skill in the pertinent art that

would lead one to combine the relevant teachings of the references, In re Fritch, 972 F.2d 1260, 1265, 23 U.S.P.Q. 2d 1780 (Fed. Cir. 1992). The Applicants respectfully submit that the Examiner has not shown the basic elements of the Claims to be in the prior art or that such knowledge is generally available to one of ordinary skill in the pertinent art. Additionally, the court in Fritch states that the prior art may not be modified absent some teaching or suggestion in the prior art supporting the modification. The mere fact that the prior art may be modified to make it more like the claimed invention does not render the invention obvious unless the prior art suggested the desirability of such a modification. The Examiner has used impermissible hindsight to combine references and attributed it to knowledge of one of ordinary skill in the art without any proof or any showing in the prior art that such is the case.

Therefore, the Applicants respectfully submit that the Examiner's rejection of amended Claims 1-8, 11-13 and 16-18 under 35 U.S.C. 103, has been overcome by the amendments and remarks, because of the absence of features of the presently claimed invention, because there has been nothing, not even a suggestion, shown in the prior art as to why the references should be combined as done by the Examiner, and because it appears that the Neal reference teaches away from both the present invention and the Am. Mach. reference, and because the article "Lasers Permit Precision Surface Treatments" (column 1, lines 34-39) does not teach laser shock peening of valve seats extending to a depth of 35 mils, for the purpose of reducing wear.

6. The Examiner's rejection of Claims 9, 10, 14, 15, 19, and 20 under 35 U.S.C. §103(a), as being unpatentable over Neal et al. (Neal) and the article "Laser Shocking Extends Fatigue Life" and the article "Lasers Permit Precision Surface Treatments" as applied in the Examiner's Rejection of Claims

8, 6, 13, 11, 18, and 16, and further in view of Fraser '252, has been carefully considered by the Applicants and the Applicants respectfully disagree. The Applicants respectfully submit that these Claims are patentable over the cited art of this Rejection because the article "Lasers Permit Precision Surface Treatments" (column 1, lines 34-39) does not teach laser shock peening of valve seats extending to a depth of 35 mils, for the purpose of reducing wear as explained above.

Therefore, the Applicants respectfully submit that the Examiner's rejection of amended Claims 9, 10, 14, 15, 19, and 20 under 35 U.S.C. 103(a), has been overcome by the amendments and remarks, because of the absence of features of the presently claimed invention, because there has been nothing, not even a suggestion, shown in the prior art as to why the references should be combined as done by the Examiner, and because it appears that the Neal reference teaches away from both the present invention and the Am. Mach. reference, and because the article "Lasers Permit Precision Surface Treatments" (column 1, lines 34-39) does not teach laser shock peening of valve seats extending to a depth of 35 mils, for the purpose of reducing wear.

Double Patenting

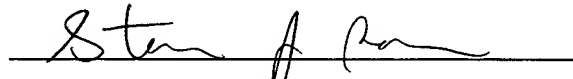
7. The Applicants acknowledge the Examiner's obvious type Double Patenting rejection of Claims 1-20 under the judicially created doctrine of double patenting over Claims 1, 1, 3, 1, 3, 1, 1, 3, 4, 4, 1, 1, 3, 4, 4, 1, 1, 3, 4, and 4, respectively, of U.S. Patent No. 5,591,009 and over Claim 1, respectively, of U.S. Patent No. 5,531,570 since the Claims, if allowed, would improperly extend the "right to exclude" already granted in the patent. Appropriate action will be taken by the Applicants upon completion of prosecution of the present Application.

Information Disclosure Statement

8. The Examiner's refusal to consider the French Patent 2,172,727 in the information disclosure statement filed December 5, 1996 has been studied and discussed with the Examiner. The Applicants are submitting a counterpart U.S. Patent No. 3,834,833 of the French patent and a copy of the European Search report which informed the Applicants of the French Patent as requested by the Examiner. The Applicants submit that this places the French patent in compliance with 37 CFR 1.98(a)(3) as it provides a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information.

9. The Applicants respectfully submit that Claims 1-20 are now in condition for allowance based on the amendments and remarks above.

Respectfully submitted,



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